PDC2015
Frascati, Roma, Italy

- ☐ **Planetary Defense – Recent Progress & Plans**
- ☐ **NEO Discovery**
- ☒ **NEO Characterization**
- ☐ **Mitigation Techniques & Missions**
- ☐ **Impact Effects that Inform Warning, Mitigation & Costs**
- ☐ **Consequence Management & Education**

IAA-PDC-15-02-12

THERMAL AND SPIN PROPERTIES OF NEAR-EARTH OBJECTS: CONSTRAINTS FROM NEXT-GENERATION INFRARED SURVEYS

T. S. Statler[(1)], T. Grav[(2)], J. Masiero[(3)], C. R. Nugent[(4)], and A. K. Mainzer[(5)]
[(1)]*Astrophysical Institute, Ohio University, Athens OH 45701, USA and NASA Headquarters, Washington DC 20546,USA;*
[(2)]*Planetary Science Institute, Tucson AZ 85719, USA;*
[(3)(4)(5)]*Jet Propulsion Laboratory, Pasadena CA, USA;*

Keywords: *Surveys, Characterization, Thermal Inertia, Rotation, Thermophysical Models*

ABSTRACT

The thermal inertias of small-body surfaces constitute important constraints on their material properties; thermal inertia measurements can distinguish between regolithic, fractured, and monolithic surfaces. When combined with rotation rates, thermal inertia measurements on fast-rotating objects can additionally constrain cohesion in the surface layers. In current practice, thermal inertias are obtained through detailed, targeted observations of individual bodies, and multiple observations—e.g., optical light curves, radar, and thermal infrared—are typically required for robust and precise results. However, the next generation of space-based infrared NEO surveys offer the potential to measure, at least coarsely, thermal inertias for hundreds to thousands of objects, as well as simultaneously constrain their spin axis orientations. This new information about the various NEO populations will give us the capability to do limited pre-characterization of potential impactors before discovery. The unique aspects of next-generation surveys that distinguish them from previous survey and targeted observations are (1) the large number of objects that will be observed at many epochs, at many different positions around their orbits, and at many different elongation and phase angles; and (2) the sparse photometry at each epoch that will undersample the rotational light curves. The primary complication that makes the data analysis difficult is that the observable effects of thermal inertia and of non-spherical shape are similar and can be hard to separate. We have generated a large grid of simulated survey observations, using state-of the art thermophysical models computed on both idealized and realistic shapes. Using these models, we demonstrate that (1) with an accurate measurement of the mean flux at each epoch, the rotation pole can be determined fairly accurately, modulo a prograde/retrograde

ambiguity; (2) with accurate measurements of both the mean flux and the rotational lightcurve amplitude at each epoch, the shape/thermal inertia degeneracy can be lifted, and order-of-magnitude (or better) determinations of the product $\Gamma/P^{1/2}$ (where Γ is thermal inertia and P is spin period) can be obtained; and (3) the systematic effects of large-scale concavities are not catastrophic, so that accurate results can still be obtained by using ellipsoids to model non-ellipsoidal objects.

****